OCR A Level Computer Science

H446/01 Computer Systems 18 December 2019

Name: **Mark:** / **63** **Grade:**

Do not use a calculator. Answer **all** questions.

1 An operating system has to manage a system's resources.

(a) One aspect of this is memory management.

(i) Describe **one** difference between paging and segmentation.

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..... **[2]**

(ii) Explain how an operating system may overcome the problem of physical memory being full.

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..... **[4]**

(b) Another job of an operating system is to deal with interrupts.

(i) State what is meant by the term ‘interrupt’.

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..... **[1]**

(ii) Describe what happens in the CPU when it receives an interrupt.

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..... **[5]**

2 Mobile Treasure Hunt is a game played on a mobile phone. The game shows the user's position on a map of their local area. Treasure randomly appears on the map and users must move to the appropriate area to collect the treasure before it disappears.

(a) State the name of a sensor or input device the phone might use when playing Mobile Treasure Hunt and explain why it might be used.

Sensor / Input Device:
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Use: .....
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..... **[2]**

Below is part of the code from Mobile Treasure Hunt.

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class Treasure

   private value
   private weight
   private name

   public procedure new(givenName)
      name=givenName
      weight=20
      value=randomInteger(1,20)
   endprocedure

   public procedure changeName(givenName)
      name=givenName
   endprocedure
endclass

class TreasureChest inherits Treasure
   private locked

   public procedure new(givenName)
      super.new(givenName)
      locked=false
      value=randomInteger(1,100)
      weight=randomInteger(80,120)
   endprocedure

   public procedure pickLock()
      if getRandomNumber()>0.5 then
         locked=false
       endif
   endprocedure

endclass
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Fig. 2.1

(b) Explain what is meant by the term ‘encapsulation’ with reference to the attribute called name.

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..... **[3]**

(c) Describe what is meant by ‘inheritance’, referring to the code in Fig. 2.1.

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..... **[3]**

(d) Identify all attributes and methods in the `TreasureChest` class.

Methods: .....
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Attributes: .....
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..... **[2]**

3 A Little Man Computer (LMC) assembly language program is stored in memory as shown in Fig. 3.1.

0	LDA &7
1	ADD #4
2	OUT
3	HLT
4	6
5	2
6	10
7	15
8	16

Fig. 3.1

In this variant of LMC the symbols & and # are used to denote different modes of addressing.

(a) Given that the output is 17, state the addressing mode represented by each symbol.

(i) &

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[1]

(ii) #

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[1]

An assembler is used on the code.

(b) Describe what is meant by the term ‘assembler’.

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(c) Explain how pipelining would help a CPU execute the code in Fig. 3.1 more quickly.

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4 Every bank account has an account number and sort code. The sort code identifies the bank branch (location of the bank) with which the account is held and the account number uniquely identifies the bank account. An extract from a bank's database table is shown in Fig. 5.1.

CustomerID	Forename	Surname	Acc No	Sort Code	Branch Name
145204	Elaine	Murray	14725200	67-34-56	Hull
657875	Jordan	Rogers	62703441	67-45-67	Truro
735951	Monim	Khan	96385547	67-00-11	Cambridge
744078	Tom	Banner	45623929	67-00-11	Cambridge

Fig. 5.1

(a) State why the table in Fig. 5.1 is not in Third Normal Form.

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..... **[1]**

(b) Explain how the database could be put into Third Normal Form.

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(c)* The bank needs to ensure the data stored in its database is accurate at all times including when customers deposit or withdraw funds.

Discuss how the bank can ensure the accuracy of its data and the importance of doing so.

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5 The XOR operator can be used to encrypt data.

(a) Show the effect of applying XOR on Text and Key, by completing the last row of the table below.

Text	O								C								R							
Value	0	1	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1	0	1	0	0	1	0
Key	A								B								C							
Value	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	1
XOR																								

[2]

(b) Show the effect of applying XOR on your answer to part (a) and Key, by completing the first and last rows of the table below.

(a)																								
Key	A								B								C							
Value	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	1
XOR																								

[2]

(c) Explain whether the type of encryption described above is symmetric or asymmetric.

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(d) Explain why asymmetric encryption is more suited to transactions over the internet than symmetric encryption.

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6 (a) Show a representation of the hexadecimal number AB in:

(i) Binary

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..... **[1]**

(ii) Denary

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(b) Show a representation of denary -119 in 8-bits using:

(i) Sign and Magnitude

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..... **[1]**

(ii) Two's Complement

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..... **[1]**

(c) A floating point number is represented with a mantissa of 8-bits followed by an exponent of 4-bits, both in two's complement.

00011010 0010

(i) Identify whether or not the number is normalised.

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..... **[1]**

(ii) State how you arrived at your answer to part (i).

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..... **[1]**

(d) Two floating point numbers are shown below in the same format as used for part (a). Calculate the answer of the second number subtracted from the first. You must show your working and ensure your answer is normalised.

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END OF QUESTION PAPER